SECTION V. MAINTENANCE

6.5.1 INTRODUCTION

The visibility sensor requires a few, simple maintenance procedures. In general, the maintenance schedule depends upon the influence of local environmental factors near and about the installation site. Corrective maintenance is divided into two areas. The troubleshooting procedure is used when data transfer communications with the sensor have failed. The diagnostic procedure is used when data communications with the sensor are available. The source of any faults can thereby be quickly detected and identified.

6.5.2 PREVENTIVE MAINTENANCE

6.5.2.1 **General**. The preventive maintenance schedule for the visibility sensor is provided in table 6.5.1. Routine cleaning and inspection of the sensor, as described in table 6.5.2, should be performed every 90 days and whenever the maintenance technician visits the site. The maintenance log should be updated and any problems noted at each interval.

Table 6.5.1. Visibility Sensor Preventive Maintenance Schedule

Interval	What To Do	How To Do It
90 days	Routine cleaning and inspection	Table 6.5.2
	Calibration	Table 6.5.3

6.5.2.2 **Calibration**. The visibility sensor must be calibrated every 90 days or after any corrective maintenance action. Before the sensor can be calibrated, it must be properly installed and must pass its ASOS diagnostics checks. Table 6.5.3 provides the procedure to calibrate the visibility sensor. Calibration is performed using the laptop computer to issue "V_" commands and receive the sensor's responses. Paragraph 6.4.4 provides a detailed description of these responses.

6.5.3 CORRECTIVE MAINTENANCE

6.5.3.1 **General**. Corrective maintenance is performed only when a malfunction occurs. Manual troubleshooting as well as diagnostic testing procedures are provided for the sensor. The troubleshooting procedure is used when data transfer communications with the sensor have failed. The diagnostics procedure is used to automatically isolate faults when communications with the sensor are available.

6.5.3.2 **AC and DC Power Troubleshooting**. The dc and ac power checks used in troubleshooting are provided in tables 6.5.4 and 6.5.5, respectively. After all dc and ac power checks have been performed and the sensor communications are still not possible or are error prone, the fiberoptic module must be checked using the procedures in Chapter 1. If the fiberoptic module checks good, the failure must be located in the RS-232 link with the processor board. The processor board must then be removed and replaced.

6.5.3.3 **Heater** Troubleshooting. The visibility sensor has heater elements located in the main electrical enclosure, the day/ night sensor, the transmit head assembly, and the receiver head assembly. The heater power supply supplies power to all of these heater assemblies. A temperature sensor switch, located in the lower right corner of the main electrical enclosure, controls the application of heater power to the heating elements. During normal system operation, the temperature sensor switch closes when the temperature within the main electrical enclosure is below 40 degrees Fahrenheit and applies 24 volts to the heater elements. The processor board monitors the current flow through the heater elements and reports this status on the visibility sensor maintenance page. Five faults can affect proper operation of the heater circuitry: failure of the heater

power supply, failure of one or more of the heater elements, failure of the regulator circuit board (3A1), failure of the processor card monitor circuit, or failure of the temperature sensor. The current status of the visibility sensor's maintenance page should be reviewed prior to troubleshooting the heater control circuit. The troubleshooting procedures provided in table 6.5.6 can then be used to troubleshoot the sensor.

$ Common visibility heater specifications, all with tolerances of +/- 5%:
$
$ Window Heater - 115 ohms
$ Hood Heater - 12 ohms
$ Electronics Heater - 53.6 ohms thru 63 ohms
$ Day/Night Window Heater - 115 ohms
$ Day/Night Electronics Heater - 100 ohms
$
$ With all heaters on, nominal current draw is 2.4966 amps (maximum is 2.7594 amps).

6.5.4 **DIAGNOSTICS**

6.5.4.1 **Introduction**. The visibility sensor is provided with a continuous self-test (CST) that runs automatically as a part of normal ASOS operation. The technician can also selectively run a diagnostic test on demand. The operation of the CST software does not interfere with the collection, processing, storage, or reporting of data. All of the diagnostic capabilities of the sensor may be exercised by the technician from the OID. Processor Board, PN 32194-1, with V036 firmware loaded, contains a "V3" command. V3 guides the technician in a step-by-step procedure to measure current draw of each heater element, using a supplied jumper. Procedural instructions are included in the firmware so that the OID displays each procedural step. No special test equipment or fixtures are needed to perform the "V3" measurement, and the visibility sensor need not be in ASOS mode. Sensor calibration is not required after the "V3" measurement.

The diagnostic capability of the visibility sensor is designed to check and monitor the major signal paths of the sensor to detect any possible failures. Each of the sensor heaters is monitored by current sensors. The outdoor temperature is monitored, and if the range is such that heaters are to be operational, software algorithms look for cycling (on and off) of the heaters. Every power supply output voltage is monitored by the processor board through a multiplexer and sensing circuit. If any level is out of range, a software flag is set to notify the technician to replace the corresponding FRU.

Signals generated by the various detectors are monitored to check for out-of-range values. Any discrepancies result in the setting of a software flag that notifies the technician to replace the associated FRU. In addition, random access memory (RAM), read-only memory (ROM), electrically erasable programmable read-only memory (EEPROM), and address self-test checks are run by the processor board to continually monitor its own operation. All diagnostics are available to the technician at the OID during normal operation.

6.5.4.2 **Executing Diagnostics**. The visibility sensor executes its own diagnostic routine during normal operation to detect any failures in operation. The results of this diagnostic routine are reported to the ASOS system software as a part of its normal data gathering process. Any failures that are detected are displayed at the OID as well as reported in the maintenance log. The visibility sensor page displayed at the OID also allows the technician to perform a detailed diagnostic test on the sensor. The test is initiated by selecting the TEST option from the display. The results of the test process are then displayed for the technician at the OID. A description of the visibility sensor page and its fields is provided in Chapter 1.

6.5.5 **FRU REMOVAL AND INSTALLATION**

FRU removal and installation are easily accomplished with simple handtools.

6.5.5.1 **Receiver Assembly Removal and Installation**. The procedures required to remove and install the visibility sensor receiver assembly are provided in table 6.5.7.

6.5.5.2 **Transmitter Assembly Removal and Installation**. The procedures required to remove and install the visibility sensor transmitter assembly are provided in table 6.5.8.

6.5.5.3 **Processor Board Removal and Installation**. The procedures required to remove and install the processor board are provided in table 6.5.9.

6.5.5.4 **Day/Night Assembly Removal and Installation**. The procedures required to remove and install the day/night assembly are provided in table 6.5.10.

6.5.5.5 **Electronics Power Supply Removal and Installation**. The procedures required to remove and install the electronics power supply are provided in table 6.5.11.

6.5.5.6 **Fiberoptic Module Removal and Installation**. The procedures required to remove and install the fiberoptic module are provided in table 6.5.12.

6.5.5.7 **Crossarm Assembly Removal and Installation**. The procedures required to remove and install the crossarm assembly are provided in table 6.5.13.

6.5.5.8 **Electronics Enclosure Removal and Installation**. The procedures required to remove and install the electronics enclosure are provided in table 6.5.14.

6.5.5.9 **Regulator Board Removal and Installation**. The procedures required to remove and install the regulator board are provided in table 6.5.15.

Table 6.5.2. Visibility Sensor Cleaning and Inspection

Step	Procedure
	WARNING Death or severe injury may result if power is not removed from the sensor prior to maintenance activities. Ensure that circuit breaker supplying power to the sensor is in the OFF (right) position.
1	Inspect ac and signal wiring that supplies the visibility sensor enclosure and ac and signal cables that route from enclosure to sensor's transmitter, receiver, and day/night assemblies.
2	Ensure that all visibility sensor cable connectors are secure.
3	Inspect inside of transmitter, receiver, and day/night assembly housings (assemblies) for dirt, spider webs, birds' nests, or any other obstructing material that may disrupt optical path.
4	**NOTE** Spider webs can float in air currents and attach across sample volume. Webs may be almost invisible to the human eye but can severely effect performance of sensor. Using a soft cloth, remove any evidence of window fouling. Gently brush cloth over critical areas that may appear to be clean, such as lip of assembly and support pole where scatter plate attaches. Make several passes through sensing volume with an arm or pole to ensure that there is no contamination.
5	Using soft cloth and a commercially available glass cleaner, clean protective glass windows of transmitter, receiver, and day/night assemblies.

Table 6.5.3. Visibility Sensor Calibration

Step	Procedure
	NOTE Before running the Visibility Calibration Check, check continuity of all nine visibility sensor heaters per table 6.5.6. Figure 6.5.1 provides a sample visibility sensor calibration data sheet. Copies of this form should be made and used to record values as directed in this procedure. Tools required: Laptop computer with PROCOMM Plus installed Visibility sensor calibration kit Laptop interface (Y-shaped) cable Large flat-tipped screwdriver Small flat-tipped screwdriver Window cleaner and soft cloth Dark opaque cloth Tape measure **CAUTION** Adverse weather conditions can affect the accuracy of the visibility calibration. Calibration should only be performed under the following conditions: winds less than 10 knots, ambient visibility greater than 2.5 miles, and no precipitation or blowing snow.
	INITIAL SETUP PROCEDURE
1	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to off (right) position.
2	During initial installation or TX/RX replacement only, verify that TX and RX canisters are fully seated in hood. This can be verified by measuring the distance from the back of the hood down to the end of TX or RX canister body. The distance should be at least 1.0 inch. If not, slide canister out 1 inch and then push canister back in until fully seated.
3	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
4	Using small flat-tipped screwdriver, disconnect visibility sensor DB-9 connector from fiberoptic module inside electronics enclosure.
5	Using laptop computer interface (Y-shaped) cable, connect RS-232C (COM1) port of laptop computer to DB-9 connector removed from fiberoptic module.
6	Turn on laptop computer and initialize PROCOMM Plus program. After program initializes, press any key to enter terminal mode (blank) screen.
7	Using ALT-S command (setup facility), set up the following TERMINAL OPTIONS: a. Terminal emulation: VT220 b. Duplex: FULL c. Soft flow control (XON/XOFF): OFF d. Hard flow control (CTS/RTS): OFF e. Line wrap: OFF f. Screen scroll: ON g. CR Translation: CR h. BS Translation NON-DESTRUCTIVE i. Break length (milliseconds): 035 j. Enquiry: OFF k. EGA/VGA true underline: OFF l. Terminal width: 80 m. ANSI 7 or 8 bit commands: 8 BIT

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
8	Press ESC key to exit to terminal mode (blank) screen.
9	Using ALT-P command (line/port option), set CURRENT SETTINGS as follows: a. Baud rate: 2400 b. Parity: NONE c. Data bits: 8 d. Stop bits: 1 e. Port: COM1
10	Press ESC key to exit to terminal mode (blank) screen.
11	Set laptop computer CAPS LOCK to ON.
12	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to on (left) position.
13	Verify that laptop computer displays sensor initialization message shown below: ***VIS VER XXX - 6220*** The XXX refers to sensor firmware version number and 6220 refers to sensor model number. Record firmware version number on calibration data sheet.
14	At laptop computer, enter VG <CR>. Sensor enters Extended Diagnostics (VG) mode and responds with: VPXXXXXXXXPPPP PPP PP PPP PPPP XXXX XX Sensor status bytes reported above should be all P's for pass. Values marked with X above may be any value (don't care), depending on prevailing visibility, ambient temperature, etc.
15	At laptop, press CTRL A then enter VF. Sensor responds with Need Password to disable ASOS mode: PASSWORD?...==>. **NOTE** CTRL A puts the sensor into Maintenance Mode. Be sure to press CTRL A again to put the sensor back into ASOS Mode before leaving.
16	Enter EIEIO <CR>. Sensor enters Calibration Coefficients/Configuration Information (VF) mode and displays information shown below (one line at a time). The table below also shows correct values for each line. If data in any line are incorrect, enter correct value at ==> prompt and enter <CR>. If data are correct or correct value is XXXXXX (don't care), enter <CR> to accept data as is. This should be performed at each line of VF command. Sensor Response — Correct Value E2PROM chk_sum = XX EO = XXXXXXXXX...==> — Note 1 FO = XXXXXXXX....==> — XXXXXX WINDOW = 113.999999...==> — 113.9999999 VIS_SER_NO? XXXX...==> — Note 2 Day/Night installed? (Y or N) [Y]> — Y Heaters installed? (Y or N) [Y]> — Y Note 1 - Enter Belfort Calibration Kit extinction coefficient (EXCO) value labeled on scatter plate and filters in EO field. EXCO is usually a 4-digit number (i.e., 1.572) and should be entered as such. EO is a 9-digit floating point field; therefore, up to 8 digits and a decimal point may be entered.

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
	Note 2 - Verify that sensor serial number on nameplate located on electronics enclosure door is the same as entered here. If not, enter correct serial number. Up to four digits may be entered in this field. After entering final <CR>, sensor retransmits corrected data entered above as well as the following: New Cksum = XX Old Cksum = XX ---> End of vF <---
17	At laptop computer, enter VH. Sensor enters Calibration Factors (VH) mode and responds with information shown below (one line at a time). The table below also shows correct values for each line. If data in any line are incorrect, enter the correct value at the ==> prompt and enter <CR>. If data are correct or correct value is XXXXXX (don't care), enter <CR> to accept data as is. This should be performed at each line of VH command. Record values for FE and FI on calibration data sheet. Sensor Response — Correct Value FE = 0.918000...==> — Note 1 FI = XXXXXXX...==> — -1.0 to +1.0 (Note 2) EDGE_OF_DAY = 90.000000...==> — 90.0 EDGE_OF_NIGHT = 30.000000...==> — 30.0 DAY_NIGHT_ZERO = 5...==> — 5 Note 1 - FE value will be whatever calibration constant was entered into sensor during last calibration, and will typically range from 0.50 to 1.80. Note 2 - If FI value is not between -1.0 and +1.0, noise is probable problem. Perform the following: a. Check all grounds on crossarm and electronics enclosure. b. There is a very small chance that the problem is in the processor board. Replace and retest. c. In fewer cases, the site ground, as a function of soil conditions and conductivity, is a factor. After entering final <CR>, sensor retransmits corrected data entered above as well as the following: New Cksum = XX Old Cksum = XX ---> End of vH <---
18	At laptop computer, enter VP. Sensor responds with request for delay. Enter 5 <CR> to put sensor into Automatic Reporting (VP) mode. Automatic Reporting mode transmits data to laptop computer every 5 seconds. Data are presented in eight columns as follows: XXXXXX XXXXXX XXXXXX XXXXXX X XXXXXX XXXX XXXXXXXX

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
	Columns of data in VP output message are as follows: Group — Contents 1 — Latest flash measurement 2 — Latest dark measurement 3 — (Flash counts - dark counts) + 100 4 — Latest day/night measurement 5 — Latest day/night status 6 — Reserved 7 — Latest visibility in miles 8 — Latest extinction coefficient (EXCO) in /km Automatic Reporting mode and EXCO of column 8 is used throughout the rest of this procedure to aid in validating calibration steps.
	VISIBILITY ZERO ADJUSTMENT
1	At visibility sensor, place opaque filter from calibration kit over receiver window. **NOTE** You can also install the calibration plate now to save time. Verify the dark measurement in column 2 of VP is 512 ±5. If dark measurement is not within tolerance, the problem is in the receiver. Perform the following: a. Check opaque filter for cracks. This can best be done by removing opaque filter from receiver, installing it on transmitter, and looking for light leaks when the transmitter flashes. Ensure that O-ring is in place. b. Remove and replace receiver assembly.
2	With the opaque filter in place, wait 5 minutes for reading of column 8 of VP to stabilize to a value near zero. Reading may be considered stable when column 8 changes less than ±0.01 over six consecutive VP updates. If value in column 8 does not stabilize, noise is probable problem. Perform the following: a. Check all grounds on crossarm and electronics enclosure. b. Check opaque filter for cracks or leaks by removing opaque filter from receiver, installing it on transmitter, and looking for light leaks when transmitter flashes. Ensure that O-ring is in place. c. There is a possibility that the problem is in the processor board. Replace and retest. d. In fewer cases, the site ground, as a function of soil conditions and conductivity, is a factor.

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
3	At laptop computer, enter VZ. Sensor enters Zero State Calibration (VZ) mode and displays the following: FROM VZ-> OLD FI = XXXXXXXXX SAMPLE: XXX SAMPLE field counts down from 120 to 0 over a 1-minute period. Sensor then prompts to accept (Y) or reject (N) new zero calibration value FI. The perfect FI value is 0.00. If new FI value is between ±1.0, record new FI value and enter Y. Entering an N or doing nothing leaves the old number in FI. If new FI value is not between ±1.0, noise is probable problem. Perform troubleshooting actions described in step 2. If new FI value is >1.00, replace the receiver.
4	With opaque filter still in place, verify that sensor EXCO in column 8 of VP is between -0.005 and +0.005. Record this EXCO value on calibration data sheet. If EXCO is not within tolerance, repeat step 2. If acceptable EXCO value cannot be achieved, noise is probable problem. Perform troubleshooting actions described in step 2.
5	At laptop computer, enter VF. Sensor enters VF mode (as in initial setup procedure, step 15). Enter <CR> to bring up FO data line. Enter value of FI obtained in step 2 in FO line followed by <CR>. Enter <CR> four additional times to exit VF mode. This process stores zero calibration value for future reference; it is not used by sensor for measurement purposes.
6	At laptop computer, enter VD. Sensor responds with request for number of samples as shown below: From VD -> Number of samples? 120...==> To accept default of 120, press <CR>. Sensor enters Standard Deviation of Zero Drift (VD) mode and counts down from 120 to 0 over a 1-minute period. Sensor then displays the following: std_dev = XXXXXXXX Standard deviation VIS: XXXXXXXXXX ---> End of vD <--- Value of standard deviation VIS should be greater than 100. Record this value on calibration data sheet. If standard deviation VIS is not greater than 100, noise is probable problem. Perform troubleshooting actions as described in step 2.
7	Remove opaque filter from receiver and store in calibration kit.
VISIBILITY CALIBRATION CHECK	
1	Remove two neutral density filters from calibration kit. Verify that calibration plate is not warped or cracked. If it is, obtain complete new calibration kit (plate and both filters) before proceeding. Clean neutral density filters and calibration plate with soft cloth and window cleaner. Also, clean transmitter and receiver windows before installing filters. Install neutral density filter marked with TX over transmitter window and filter marked with RX over receiver window. **NOTE** During initial installation or when visibility head is replaced only, verify that calibration plate is centered equidistant between TX and RX heads. Use tape measure to measure from front tip of each head to upper corner of calibration plate. Distance should be ±¼ inch between sides.
2	Record EXCO value marked on calibration plate on calibration data sheet. Install calibration plate (with side labeled TOP upward) to top sensor support pole using knurled knobs. Using tape measure, ensure that calibration plate is mounted equidistant (±1 inch) between transmitter and receiver heads.

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
3	Wait 5 minutes and observe that column 8 of VP is within ±5% of value of EXCO written on calibration plate and filters.
4	At laptop computer, enter VS. Sensor enters Span State Calibration (VS) mode and displays the following: FROM VS-> OLD FE = XXXXXXXXX SAMPLE: XXX SAMPLE field counts down from 120 to 0 over a 1-minute period. Sensor then prompts to accept (Y) or reject (N) new span calibration value FE. If new FE value is between 0.5 and 4.0, enter Y. Entering N or doing nothing leaves old number in FE. Record new FE value on calibration data sheet. If new FE value is not between 0.5 and 4.0, problem is optical in nature. Perform the following: a. Pull transmitter and receiver assemblies and inspect and clean windows. Ensure that no foreign objects are in the optical path. b. Check for damage on calibration kit, including both calibration plate and neutral density filters. Ensure that both plate and filters are clean and have correct part number. c. Remove and replace transmitter assembly. d. Remove and replace receiver assembly.
5	Record final EXCO value from column 8 of VP on calibration data sheet. If step 4 was performed and adjustment was made, wait 10 minutes for EXCO value to stabilize before recording value.
	DAY/NIGHT SENSOR CHECK
1	Cover window of day/night sensor with dark cloth.
2	Observe that column 4 of VP decreases below 30 and that column 5 switches from D (day) to N (night).
	SENSOR HEATER CALIBRATION
	NOTE Whenever the visibility crossarm, transmit canister, receiver canister, or day/night sensor have been replaced, the Heater Power Supply Check and the Heater Calibration procedure must be run, but first, check continuity of all nine heater elements per table 6.5.6.
	Heater Power Supply Check
1	Disconnect hood/electronics heater thermostat from backplane connector J7.
2	Jumper contacts on electronics assembly backplane connector J7 together using jumper assembly supplied with visibility calibration kit. This connection enables the hood and electronics heaters.
3	Set DMM for dc volts and connect DMM (-) terminal to heater power supply capacitor C2 negative terminal. Connect DMM (+) lead to C2 positive terminal.
4	Adjust R4 at heater supply board for 24.00 vdc ±0.25 as read on DMM. If DMM shows no voltage, check ac power supply fuse (F2) and replace if necessary; otherwise, replace electronics power supply and repeat steps 3 and 4.
	Heater Calibration
5	Unlatch two fasteners and carefully remove transmitter assembly cap from back of transmitter assembly.
6	Using small flat-head screwdriver, slide locking mechanism (plate in front of connector) in transmitter assembly to unlock connector DB-9. Do not disconnect connector.
7	Repeat steps 5 and 6 for receiver assembly.

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
8	Enter V3. The sensor enters heater calibration mode and displays the following instructions: HEATER "CALIBRATION" PLEASE INSERT A JUMPER ACROSS THE CONTACTS OF J7 ON THE BACKPLANE. PRESS <ENTER> WHEN DONE **NOTE** Ensure the canisters are warm to the touch.
9	Jumper contacts on backplane connecter J7 together using jumper assembly supplied with visibility calibration kit. This connection enables hood and electronics heaters. Press <ENTER>. The system displays the following: READING ALL OF THE HEATERS FOR 10 SECONDS. RCV_HTR_VOLTS_AVE X.XXX XMT_HTR_VOLTS_AVE X.XXX (where X.XXX is the average voltage measured) PLEASE DISCONNECT THE "CANISTER" CONNECTOR IN THE RECEIVER HOOD. PRESS <ENTER> WHEN DONE
10	Disconnect connector DB-9 in receiver hood which was loosened in step 6. Press <ENTER>. The system displays the following: READING THE RECEIVER CROSSARM HEATERS FOR 10 SECONDS. .....DONE RX_XARM_HTR X.XXX (where X.XXX equals the average voltage read) PLEASE RECONNECT THE "CANISTER" CONNECTOR IN THE RECEIVER HOOD AND DISCONNECT THE HEATER CONNECTOR FROM THE RECEIVER HOOD PRESS <ENTER> WHEN DONE
11	Using small flat-head screwdriver, reconnect connector DB-9 in receiver hood and disconnect heater connector from receiver hood (molex connector). Press <ENTER>. The system displays the following: READING THE RECEIVER HEATER ELECTRONICS HEATER FOR 10 SECONDS. ..... DONE RX_EL_HTR X.XXX (where X.XXX equals the average voltage measured) PLEASE RECONNECT THE HEATER CONNECTOR ON THE RECEIVER HOOD AND DISCONNECT THE "CANISTER" CONNECTOR ON THE TRANSMITTER HOOD. PRESS <ENTER> WHEN DONE

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
12	Reconnect heater connector on receiver hood and disconnect connector DB-9 on transmitter hood, which was loosened in step 6. Press <ENTER>. The system displays the following: READING THE TRANSMITTER CROSSARM FOR 10 SECONDS. .....DONE TX_XARM_HTR X.XXX (where X.XXX equals the average voltage read) PLEASE RECONNECT THE "CANISTER" CONNECTOR ON THE TRANSMITTER HOOD AND DISCONNECT THE HEATER CONNECTOR FROM THE TRANSMITTER HOOD. PRESS <ENTER> WHEN DONE
13	Using small flat-head screwdriver, reconnect connector DB-9 in transmitter hood and disconnect heater connector from transmitter hood. Press <ENTER>. The system displays the following: READING THE HEATER ELECTRONICS FOR 10 SECONDS. ..... DONE TX_EL_HTR X.XXX (where X.XXX equals the average voltage measured) NEW CKSUM = NN OLD CKSUM = NN RX_HD = X.XX (receiver hood heater average voltage) RX_EL = X.XX (receiver electronics heater average voltage) RX_WN = X.XX (receiver window heater average voltage) TX_HD = X.XX (transmitter hood heater average voltage) TX_EL = X.XX (transmitter electronics heater average voltage) TX_WN = X.XX (transmitter window heater average voltage) DN_WN = X.XX (day/night sensor window heater average voltage) DON'T FORGET TO RECONNECT THE HEATER POWER CONNECTOR ON BOTH HOODS. **NOTE** Press ENTER before removing J7 jumper. You want to settle the current levels before J7 jumper is removed. DON'T FORGET TO RECONNECT THE HEATER THERMOSTAT TO BACKPLANE J7.
14	Reconnect heater power connectors on both hoods and reconnect heater thermostat to backplane connector J7.
15	Enter VG. The system displays the following: VFXXXXXXXXPPPP PFPOPP PPP PPPP XXXX XX ^ ^ NOTE: The symbol ^ denotes the bytes indicating failure. These symbols will not appear on the display.
16	Enter VG again. The system displays the following: VPXXXXXXXXPPPP PPPOPP PPP PPPP XXXX XX ^ ^
17	At DCP, turn visibility sensor circuit breaker to OFF.

Table 6.5.3. Visibility Sensor Calibration -CONT

Step	Procedure
18	Using small flat-head screwdriver at receiver assembly DB-9 connector, press up on locking mechanism to lock connector DB-9.
19	Repeat step 18 for transmitter assembly.
20	Install transmitter assembly cap and latch two fasteners.
21	Install receiver assembly cap and latch two fasteners.
22	Perform teardown procedure.
	TEARDOWN
1	**NOTE** Step 1 must be performed to reset sensor to ASOS operational mode. To exit calibration procedure, press CTRL-A. Sensor responds with: RESET TO ASOS MODE NEW CKSUM = XX OLD CKSUM = XX
2	Repeat initial setup procedure step 13 to verify that all sensor diagnostics pass.
3	At laptop computer, press ALT-X (exit) to exit PROCOMM Plus.
4	Turn off laptop computer.
5	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to off (right) position.
6	Disconnect cables between laptop computer and visibility sensor.
7	Using small flat-tipped screwdriver, connect visibility sensor DB-9 connector to fiberoptic module.
8	Using large flat-tipped screwdriver, close and secure visibility sensor electronics enclosure access door.
9	Remove calibration plate and two filters and store in calibration kit.
10	Clean transmitter, receiver, and day/night windows to remove any fingerprints.
11	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to on (left) position.

VISIBILITY SENSOR CALIBRATION PROCEDURE

DATA SHEET

SITE SID: _____ OPERATOR: _____

SENSOR S/N: _____ DATE: _____

REF. STEP	PARAMETER	EXPECTED VALUE	RECORDED VALUE
INITIAL SETUP PROCEDURE			
13	Firmware Ver.	≥034	
17	FE Value	0.50 - 1.80	
17	Current FI Value	≤1.0	
VISIBILITY ZERO ADJUSTMENT			
2	New F1 Value	between ±1.0	
3b	Zero EXCO	<±0.005	
5	Standard Deviation VIS	>100	
VISIBILITY CALIBRATION CHECK			
2	Cal Plate EXCO	XXXXX	
4*	New FE Value	0.50 - 1.80	
5	Sensor EXCO	±5% of Cal Plate	
DAY/NIGHT SENSOR CHECK			
2	D/N Switch	Yes	

(*) Only fill in a new FE value if step 4 (Span State Calibration) was performed; otherwise, mark with N/A.

Figure 6.5.1. Visibility Sensor Calibration Data Sheet

Table 6.5.4. DC Power Checks

Step	Procedure
	WARNING Dangerous voltage levels are present within visibility sensor's electronics enclosure. **NOTE** If output of any power supply is low, problem may be due to an overload by one or more of the FRU(s). In such a case, technician should disconnect load and recheck power supply output. If power supply output still fails, replace power supply. If power supply output is then good, troubleshoot to faulty load FRU using visibility sensor diagrams (figures 6.4.2 and 6.4.3).
1	Perform ac power check in accordance with table 6.5.5.
2	Using digital multimeter (DMM), connect positive lead to terminal TB1-4 on electronics power supply PS1 and negative lead on terminal TB1-3. Voltage should be +5 ±0.5 vdc. If correct voltage is not present, replace power supply PS1.
3	Using DMM, connect positive lead to terminal TB1-7 on electronics power supply PS1 and negative lead on terminal TB1-6. Voltage should be +15 ±1.5 vdc. If correct voltage is not present, replace power supply PS1.
4	Using DMM, connect positive lead to terminal TB1-5 on electronics power supply PS1 and negative lead on terminal TB1-6. Voltage should be -15 ±1.5 vdc. If correct voltage is not present, replace power supply PS1.
5	Using DMM, connect positive lead to terminal TB1-5 on heater power supply and negative lead on terminal TB1-4. Voltage should be +24 ±5 vdc. If correct voltage is not present, troubleshoot heater power supply using procedures in paragraph 6.5.3.3.

Table 6.5.5. AC Power Checks

Step	Procedure
	WARNING Dangerous voltage levels are present within visibility sensor electronics enclosure.
1	Using DMM, measure ac voltage between terminals 1 and 2 on electronics power supply PS1 in electronics enclosure. Voltage should be 104 to 127 vac. If correct voltage is not present, check fuse F2 (¼ amp, 250V) on heater power supply and replace if blown. If fuse is good and correct voltage is still not present, proceed to step 2.
2	Open power input box within electronics enclosure by removing six Phillips screws securing access cover to power input box.
3	Using DMM, measure ac power input between terminals 1 and 2 of terminal TB1 in power input box. Voltage should be 104 to 127 vac. If correct voltage is not present, troubleshoot power wiring back to DCP.
4	Using DMM, measure ac output between terminals L0 and N of line protector E2 in power input box. Voltage should be 104 to 127 vac. If correct voltage is not present, replace electronics enclosure in accordance with procedure in table 6.5.14. If voltage is 104 to 127 vac in a two-filter configuration, use DMM to measure output between terminals LO and N of line protector E1 in power input box. If correct voltage is not present, replace electronics assembly in accordance with procedure in table 6.5.14.
5	Install cover on power input box and secure using six Phillips screws.

Table 6.5.6. Heater Troubleshooting

Step	Procedure

WARNING

Death or severe injury may result if power is not removed from sensor prior to performing maintenance activities. Dangerous voltages (110 vac) are present within the visibility sensor. Exercise standard safety procedures.

1 Only one or two of the heater tests failed.

a. Using functional diagram (Figure 6.4.2), check for approximately 24 volts between heater input terminal and ground. If 24 volts is not present, proceed to step 2.

b. If 24-volt signal is present, set circuit breakers for Visibility Heaters and Visibility Electronics OFF.

c. At visibility sensor electronics assembly, disconnect connector/wires at the following points to check continuity of individual heater elements:

Connector/TB	Pins/Terminals	Heater Element
W2P3	1 - 2	Xmtr Hood
W2P3	1 - 3	Xmtr Window
W3P3	1 - 2	Rcvr Hood
W3P3	1 - 3	Rcvr Window
W2P2	E8 - E9	D/N Window & D/N Elec
Htr Pwr Sup TB1	1 - 2	Xmtr Elec Encl, Rcvr Elec Encl, Vis Sens Elec Encl

d. Perform the following resistance checks:

J5 - P1 Receiver Connector on Main Board - remove connector from the main board and measure on J5 which is wired to RX head.

Pins 10 and 12 - 115 ohms - Receiver Window Heater

Pins 11 and 12 - 12 ohms with both RX head connectors in place
58 ohms with only the white heater connector separated
14 ohms with only the DB-9 Canister connector removed from RX canister.

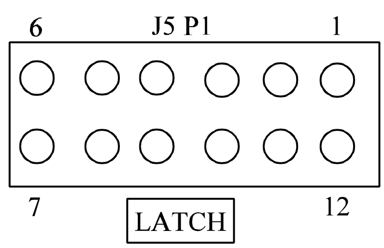


Table 6.5.6. Heater Troubleshooting -CONT

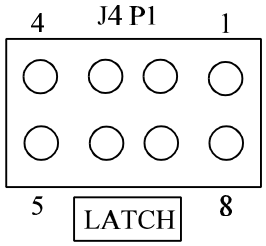
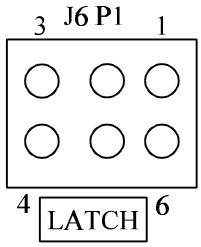
Step	Procedure
	J4 - P1 Transmitter Connector on Main Board - remove connector from the main board and measure on J4 which is wired to TX head. Pins 3 and 5 - 115 ohms - Transmitter Window Heater Pins 4 and 5 - 12 ohms with both TX head connectors in place 58 ohms with only the white heater connector separated 14 ohms with only the DB-9 Canister connector removed from TX canister.  J6 - P1 Day/Night Sensor on Main board - remove connector from the main board and measure on J6 which is wired to D/N Sensor. Pins 5 and 6 - 145 ohms heaters in D/N Sensor 

Table 6.5.6. Heater Troubleshooting -CONT

Step	Procedure
	e. If continuity or resistance tests fail, replace applicable FRU. $ $
	f. If continuity and resistance checks pass, use figure 6.4.2 and check heater wiring. Repair as necessary. $ $ $
	g. Set circuit breakers for visibility Heaters and Visibility Electronics ON. $
2	All heater elements fail to operate and the temperature of the main electrical enclosure is below 40 degrees Fahrenheit. $ $ $
	a. Check fuse F2 on heater power supply and fuse F1 on regulator circuit board (3A1) (15 amp, 32V). $ $ $
	b. If fuse F2 on heater power supply is blown, replace fuse and reapply power to unit. If fuse blows again, remove power and disconnect wires from 3A1-TB1 on regulator circuit board. Replace fuse and reapply power. If fuse blows again, replace main electrical enclosure. $ $ $ $ $
	c. If fuse F1 on regulator circuit board is blown, remove power, disconnect wires from 3A1-TB2, and replace fuse. Reapply power. If fuse blows again, replace regulator circuit board. If not, remove power and using DMM, measure resistance across terminals TB1-4 and TB1-5. DMM should indicate greater than 200 ohms. If reading is low, while observing DMM, disconnect connector J6. If correct reading is obtained, replace day/night sensor. If correct reading is still not obtained, connect connector J6 and disconnect connectors J4 and J5. If correct reading is obtained after disconnecting $ $ $ $ $ $ $ $ $

Table 6.5.6. Heater Troubleshooting -CONT

Step	Procedure
	connector J4, connect connector J4 and disconnect connector J3 at transmitter assembly. If correct reading is obtained, replace transmitter assembly. If not, replace crossarm assembly. If correct reading is obtained after disconnecting connector J5, connect connector J5 and disconnect connectors P2 and P3 at receiver assembly. If correct reading is obtained, replace receiver assembly. If not, replace crossarm assembly. d. If fuses test good, use DMM and check for continuity across temperature sensor located in lower right corner of main electrical enclosure. If continuity check fails, replace main electrical enclosure. e. If continuity check passed, apply power to sensor and use DMM to check for the presence of 24 ±2.4 volts dc between each temperature sensor terminal and ground. f. If 24-volt test failed, use DMM to measure voltage across terminals on capacitor C1 on heater power supply. Capacitor C1 is located in lower right corner of heater power supply. If DMM indicates 24.00 ±2.4 volts, replace regulator circuit board (3A1), which is located on heater power supply. g. If correct voltage reading is not obtained in step 2f, disconnect wires from terminal board 3A1TB1 on regulator circuit board and repeat measurement across capacitor C1. If correct reading is obtained, replace regulator circuit board (3A1). If not, replace main electrical enclosure.

Table 6.5.7. Receiver Assembly Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: No. 1 Phillips screwdriver Small flat-tipped screwdriver **CAUTION** Damage to equipment may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Locate receiver assembly (south end).
	WARNING With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor.
3	Lower visibility sensor on hinge plate as follows: a. Remove locking pin from hinge plate. b. From hinge side of sensor, firmly grasp support pole with both hands and carefully lower sensor on hinge until lanyard catches and supports weight of sensor.

Table 6.5.7. Receiver Assembly Removal and Installation -CONT

Step	Procedure
	CAUTION Do not strain crossarm wiring harness when removing or installing receiver assembly. Failure to comply may result in damage to hood or lens heater wiring.
4	Unlatch two fasteners and carefully remove receiver assembly cap from back of receiver assembly.
5	Disconnect molex-type cable connector.
6	Disconnect trigger signal coax wire from receiver coax connector.
7	Using Phillips screwdriver, remove screw securing green ground wire to receiver module. Disconnect green wire.
8	Using small flat-tipped screwdriver, slide locking mechanism (plate at front of connector) downward to unlock DB-9 connector. Disconnect DB-9 connector.
9	Grasp receiver module and slide module out of assembly.
	INSTALLATION
	Tools required: Small flat-tipped screwdriver No. 1 Phillips screwdriver **CAUTION** Damage to equipment may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position. **CAUTION** Do not strain crossarm wiring harness when removing or installing receiver assembly. Failure to comply may result in damage to hood or lens heater wiring.
2	Slide receiver module into assembly, seating module as far forward as possible (at least 1 inch down from back of hood).
3	Connect DB-9 connector to receiver module. Using small flat-tipped screwdriver, press up on locking mechanism to lock DB-9 connector.
4	Connect green ground wire to receiver module. Using Phillips screwdriver, install screw securing green ground wire to receiver module.
5	Connect trigger signal coax wire to receiver module.
6	Connect molex-type cable connector.
7	Slide receiver assembly cap over back of receiver assembly, being careful not to crush any wiring, and latch two fasteners securing cap.

Table 6.5.7. Receiver Assembly Removal and Installation -CONT

Step	Procedure
	WARNING With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor.
8	Raise visibility sensor on hinge plate as follows: a. From behind hinged side of sensor, firmly grasp support pole with both hands and carefully raise sensor on hinge into upright sensor. b. Install locking pin into front of hinge plate.
9	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.8. Transmitter Assembly Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: No. 1 Phillips screwdriver Small flat-tipped screwdriver **CAUTION** Damage to equipment may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Locate transmitter assembly. This is most easily accomplished by looking in assembly and locating clear colored window (receiver is yellow).
	WARNING With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor.
3	Lower visibility sensor on hinge plate as follows: a. Remove locking pin from hinge plate. b. From hinge side of sensor, firmly grasp support pole with both hands and carefully lower sensor on hinge until lanyard catches and supports weight of sensor. **CAUTION** Do not strain crossarm wiring harness when removing or installing transmitter assembly. Failure to comply may result in damage to hood or lens heater wiring.
4	Unlatch two fasteners and carefully remove transmitter assembly cap from back of transmitter assembly.
5	Disconnect molex-type cable connector.
6	Disconnect trigger signal coax wire from transmitter coax connector.

Table 6.5.8. Transmitter Assembly Removal and Installation -CONT

Step	Procedure
7	Using Phillips screwdriver, remove screw securing green ground wire to transmitter module. Disconnect green wire.
8	Using small flat-tipped screwdriver, slide locking mechanism (plate at front of connector) downward to unlock DB-9 connector. Disconnect DB-9 connector.
9	Grasp transmitter module and slide module out of assembly.
	INSTALLATION
	Tools required: Small flat-tipped screwdriver No. 1 Phillips screwdriver **CAUTION** Damage to equipment may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	**CAUTION** Do not strain crossarm wiring harness when removing or installing transmitter assembly. Failure to comply may result in damage to hood or lens heater wiring. Position the flat (on side of transmitter module) to right and slide transmitter module into assembly, seating module as far forward as possible (at least 1 inch down from back of hood).
3	Connect DB-9 connector to transmitter module. Using small flat-tipped screwdriver, press up on locking mechanism to lock DB-9 connector.
4	Connect green ground wire to transmitter module. Using Phillips screwdriver, install screw securing green ground wire to transmitter module.
5	Connect trigger signal coax wire to receiver module.
6	Connect molex-type cable connector.
7	Slide transmitter assembly cap over back of transmitter assembly, being careful not to crush any wiring, and latch two fasteners securing cap.
8	**WARNING** With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor. Raise visibility sensor on hinge plate as follows: a. From behind hinged side of sensor, firmly grasp support pole with both hands and carefully raise sensor on hinge into upright sensor. b. Install locking pin into front of hinge plate.
9	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.9. Processor Board Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver No. 1 Phillips screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	Using Phillips screwdriver, remove screw securing processor board to standoff.
4	Carefully remove processor board by pulling it free from backplane connector XA1.
	INSTALLATION
	Tools required: No. 1 Phillips screwdriver Large flat-tipped screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside DCP cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Install processor board into backplane connector XA1.
3	Using Phillips screwdriver, install screw securing processor board to standoff.
4	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.10. Day/Night Assembly Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: 7/16-inch socket and ratchet **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using 7/16-inch socket and ratchet, remove two bolts and flat washers securing flexible conduit connector for day/night sensor to enclosure support pole.

Table 6.5.10. Day/Night Assembly Removal and Installation -CONT

Step	Procedure
3	Disconnect day/night sensor cable connector A5W1-P1 from wiring harness located in support column W2-P2, being careful not to drop internal harness inside column.
4	Loosen three bolts, flat washers (two each), lockwashers, and nuts securing day/night sensor to crossarm support column. Remove sensor from column.
	INSTALLATION
	Tools required: 7/16-inch socket and ratchet **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Mount day/night sensor on crossarm support column (with sensor window facing same direction as receiver hood). Tighten three bolts, flat washers (two each), lockwashers, and nuts securing sensor to column.
3	Connect day/night sensor cable connector A5W1-P1 to wiring harness located in support column W2-P2.
4	Using 7/16-inch socket and ratchet, install two bolts and flat washers securing flexible conduit connector to support column.
5	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.11. Electronics Power Supply Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver Flat-tipped screwdriver No. 0 Phillips screwdriver No. 1 Phillips screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, set circuit breaker on visibility sensor power control module to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	Using flat-tipped screwdriver, tag and disconnect wires from power supply terminals.
4	Using No. 1 Phillips screwdriver, remove two screws, lockwashers, and flat washers securing power supply angle mount to visibility sensor electronics enclosure. Carefully lift power supply with angle mount from electronics enclosure.
5	Using No. 0 Phillips screwdriver, remove four screws, lockwashers, and flat washers securing power supply to angle mount.

Table 6.5.11. Electronics Power Supply Removal and Installation -CONT

Step	Procedure
	INSTALLATION
	Tools required: Large flat-tipped screwdriver Flat-tipped screwdriver No. 0 Phillips screwdriver No. 1 Phillips screwdriver
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using No. 0 Phillips screwdriver, install four flat washers, lockwashers, and screws securing power supply to angle mount.
3	With terminals positioned downward, slide power supply with angle mount into position.
4	Using No. 1 Phillips screwdriver, install two lockwashers, flat washers, and screws securing power supply angle mount to visibility sensor electronics enclosure.
5	Using flat-tipped screwdriver and tags as a guide, connect wires to power supply terminals.
6	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.12. Fiberoptic Module Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver (short)
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.
1	Inside equipment cabinet, set circuit breaker on visibility sensor power control module to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	Using small flat-tipped screwdriver, loosen two retaining screws on DB-9 connector located on top of fiberoptic module. Remove connector DB-9.
4	Remove six screws and lockwashers securing power input box access cover.
5	Remove access cover from power input box.
6	Using clockwise (cw) rotation, remove two fiberoptic cables from underneath fiberoptic module. Install protective plastic covers over fiberoptic connectors.

Table 6.5.12. Fiberoptic Module Removal and Installation -CONT

Step	Procedure
7	At visibility electronics enclosure, use No. 1 Phillips screwdriver to remove four screws, lockwashers, and flat washers securing fiberoptic module mounting plate to power input box. Remove fiberoptic mounting plate and gasket.
8	Using small flat-tipped screwdriver, remove four screws, four lockwashers, and gasket securing fiberoptic module to mounting plate.
INSTALLATION	
Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver (short)	
WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to off (right) position.	
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using small flat-tipped screwdriver, install four lockwashers, four screws, and gasket securing fiberoptic module to mounting plate. Ensure that DB-9 connector on module is oriented toward RCVR stencil on plate.
3	With DB-9 connector toward the front, position fiberoptic module mounting plate and gasket on power input box. Using No. 1 Phillips screwdriver, install four flat washers, lockwashers, and screws securing fiberoptic module to power input box.
4	Remove protective plastic covers from fiberoptic connectors and connect transmit (TX) cable to rear connector and receive (RX) cable to front connector of fiberoptic module.
5	Install power input box access cover and secure using six lockwashers and screws.
6	Install signal cable on connector DB-9 on fiberoptic module and using small flat-tipped screwdriver, tighten two retaining screws.
7	Using large flat-tipped screwdriver, close and secure visibility sensor electronics enclosure access door.
8	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to on (left) position.

Table 6.5.13. Crossarm Assembly Removal and Installation

Step	Procedure
REMOVAL	
Tools required: Large flat-tipped screwdriver 7/16-inch wrench	
WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to the off (right) position.	

Table 6.5.13. Crossarm Assembly Removal and Installation -CONT

Step	Procedure
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	In electronics enclosure, disconnect transmitter cable from connector J4 on motherboard.
4	In electronics enclosure, disconnect receiver cable from connector J5 on motherboard.
5	On power input box, using 7/16-inch wrench, disconnect crossarm green ground wire from stud E3.
6	Using 7/16-inch wrench, disconnect flexible conduit from electronics enclosure and support column.
7	Carefully feed the cables disconnected above out of conduit.
8	**WARNING** With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor. Lower visibility sensor on hinge plate as follows: a. Remove locking pin from hinge plate. b. From hinge side of sensor, firmly grasp support pole with both hands and carefully lower sensor on hinge until lanyard catches and supports weight of sensor.
9	Mark the orientation of receiver and transmitter heads on crossarm support column.
10	While supporting crossarm assembly and using 7/16-inch socket, remove four bolts, lockwashers, and flat washers securing crossarm assembly to crossarm support. Remove crossarm assembly and carefully pull three cables out of crossarm support.
	INSTALLATION
	Tools required: 7/16-inch wrench **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that breaker supplying power to sensor is to the off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	**NOTE** Crossarm is mounted to top of crossarm support such that transmitter and receiver hoods are to the right of electronics enclosure (on the same side of support pole as calibration plate mounts). At top of crossarm support, carefully feed wires coming out of base of crossarm assembly through interior of crossarm support and out of access hole located on bottom of electronics enclosure.
3	Using the marks placed on crossarm support column during removal of crossarm assembly, position crossarm assembly such that transmitter and receiver hoods are to the right of electronics enclosure. Ensure that receiver assembly is pointed away from direct sunlight. In the northern hemisphere, receiver should point north.
4	While supporting crossarm assembly and using 7/16-inch socket, install four bolts, flat washers, and lockwashers securing crossarm assembly to crossarm support.

Table 6.5.13. Crossarm Assembly Removal and Installation -CONT

Step	Procedure
5	At base of enclosure support, route receiver, transmitter, and ground cables through flexible conduit into electronics enclosure.
6	Using cable marker as a guide, connect transmitter cable to connector J4 on motherboard.
7	Using cable marker as a guide, connect receiver cable to connector J5 on motherboard.
8	Using 7/16-inch wrench, connect green ground cable to stud E3 on power input box.
9	Using 7/16-inch wrench, install two bolts, lockwashers, and flat washers securing lower conduit to support pole and electronics enclosure. Ensure that EMI gasket is in place.
10	Verify that TX and RX canisters are fully seated in hood by measuring the distance from the back of the hood down to the end of TX or RX canister body. The distance should be at least 1.0 inch. If not, slide canister out 1 inch and then push canister back in until fully seated.
11	**WARNING** With locking pin removed from hinge plate, sensor is not locked in upright position. Death or severe injury may result if personnel are not kept out of travel path of sensor. Raise visibility sensor on hinge plate as follows: a. From behind hinged side of sensor, firmly grasp support pole with both hands and carefully raise sensor on hinge into upright sensor. b. Install locking pin into front of hinge plate.
12	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.14. Electronics Enclosure Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver 7/16-inch wrench No. 1 Phillips screwdriver 9/16-inch wrench Large pliers ½-inch socket with ratchet
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to the off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	In electronics enclosure, disconnect receiver cable from connector J5 on motherboard.
4	In electronics enclosure, disconnect day/night sensor cable from connector J6 on motherboard.
5	In electronics enclosure, disconnect transmitter cable from connector J4 on motherboard.
6	Using 7/16-inch wrench, disconnect green ground wire from stud E3 located on top of power input box.

Table 6.5.14. Electronics Enclosure Removal and Installation -CONT

Step	Procedure
7	Using Phillips screwdriver, remove six screws securing access cover to power input box and remove access cover.
8	Disconnect the following ac power wires from terminal board TB1: Wire — Connection Black (ac hot) — TB1-1 White (ac neut) — TB1-2 Green (ground) — TB1-3
9	Disconnect transmit (TX) fiberoptic cable from TX connector on fiberoptic module.
10	Disconnect receive (RX) fiberoptic cable from RX connector on fiberoptic module.
11	Using 9/16-inch wrench, remove pedestal ground wire from ground stud located at bottom of electronics enclosure.
12	Using large pair of pliers, remove flexible conduit from base of electronics enclosure. Carefully pull wires out of enclosure.
13	Install access cover on power input box. Using Phillips screwdriver, install six screws securing access cover.
14	Using ½-inch socket and ratchet, loosen but do not remove four bolts securing electronics enclosure to support.
15	While supporting electronics enclosure, remove top two mounting bolts, four flat washers, two lockwashers, and two nuts and remove electronics enclosure from support.
	INSTALLATION
	Tools required: Large flat-tipped screwdriver 7/16-inch wrench No. 1 Phillips screwdriver 9/16-inch wrench ½-inch socket with ratchet
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to the off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position. **NOTE** Do not tighten bolts in next step. Electronics enclosures box flanges must be allowed to slip onto bolts.
2	Ensure that bolt, two flat washers, lockwasher, and nut are installed in holes on lower bracket of enclosure support.
3	Position electronics enclosure such that lower mounting flanges slip onto bolts and enclosure is resting on bolts.
4	Position electronics enclosure such that upper mounting flanges align with holes in upper mounting bracket.
5	Install mounting bolt, two flat washers, lockwasher, and nut in each flange. Using ½-inch socket and ratchet, tighten four mounting bolts.
6	Using large flat-tipped screwdriver, open visibility electronics enclosure access door.
7	Remove protective plastic covers from fiberoptic cables. Connect transmit (TX) cable to rear connector of fiberoptic module and receive (RX) cable to front connector.

Table 6.5.14. Electronics Enclosure Removal and Installation -CONT

Step	Procedure
8	Using Phillips screwdriver, remove six screws securing access cover to power input box and remove access cover.
9	Route ac power wires into power input box.
10	Using flat-tipped screwdriver, connect the following ac power wires to terminal board TB1: Wire — Connection Black (ac hot) — TB1-1 White (ac neut) — TB1-2 Green (ground) — TB1-3 on the 2-filter configuration, ensure that the following jumpers are also in place: From — To TB1-1 (ac hot) — TB1-4 TB1-2 (ac neut) — TB1-5
11	Install access cover on power input box. Using Phillips screwdriver, install six screws securing access cover.
12	Using 9/16-inch wrench, connect pedestal ground wire to ground stud located at bottom of electronics enclosure.
13	Feed wires coming out of conduit through large access hole in bottom of electronics enclosure. Position conduit in hole and install large nut securing conduit to electronics enclosure.
14	Using cable marker as a guide, in electronics enclosure, connect receiver cable to connector J5 on motherboard.
15	Using cable marker as a guide, in electronics enclosure, connect transmitter cable to connector J4 on motherboard.
16	Using cable marker as a guide, in electronics enclosure, connect day/night sensor cable to connector J6 on motherboard.
17	Using 7/16-inch wrench, connect green ground wire to stud E3 located on top of power input box.
18	Inside equipment cabinet, set circuit breaker on visibility sensor circuit breaker module to on (left) position.
19	Calibrate visibility sensor in accordance with table 6.5.3.

Table 6.5.15. Regulator Board Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver No. 1 Phillips screwdriver
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to the off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using large flat-tipped screwdriver, open visibility sensor electronics enclosure access door.
3	At regulator board, tag and disconnect wires from terminal board TB1 and TB2.
4	Using Phillips screwdriver, remove fours screws, flat washers, and lockwashers securing regulator board to heater power supply board. Remove regulator board.
	INSTALLATION
	Tools required: No. 1 Phillips screwdriver
	WARNING Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker supplying power to sensor is set to the off (right) position.
1	Inside equipment cabinet, ensure that circuit breaker on visibility sensor circuit breaker module is set to off (right) position.
2	Using Phillips screwdriver, install four screws, lockwashers, and flat washers securing regulator board to heater power supply board.
3	**NOTE** The red wire terminals are marked with red paint. Using tags as a guide, connect wires to terminal board TB1 and TB2.
4	Calibrate visibility sensor in accordance with table 6.5.3.